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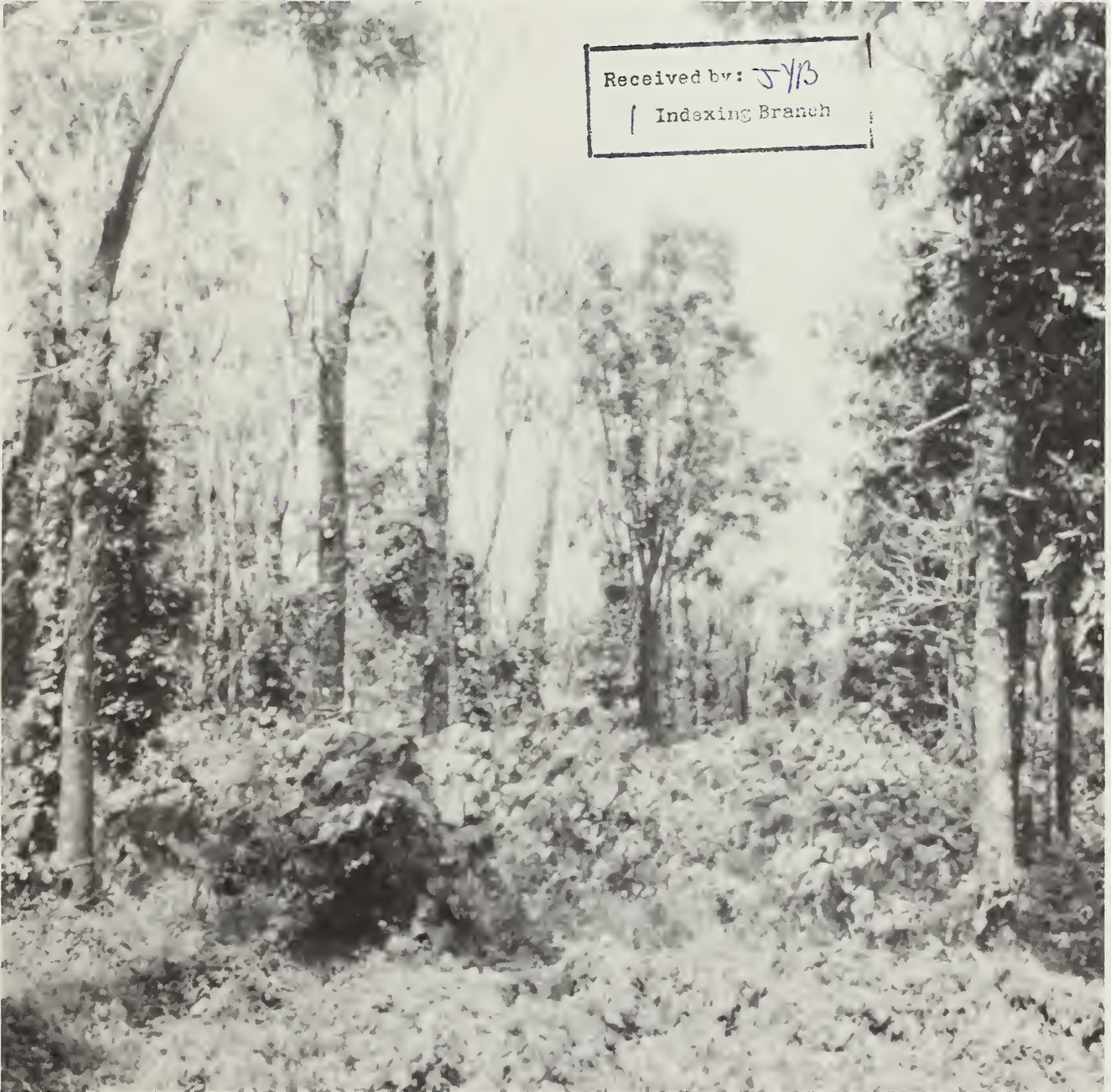


# Timber Resources of Kosrae, Pohnpei, Truk, and Yap, Federated States of Micronesia

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Cover: A distributed plantation of mahogany, one of the major species used for reforestation in the Federated States of Micronesia. Note the growth of secondary species due to the open condition of the stand.

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## INTRODUCTION

The Federated States of Micronesia consists of four States: Kosrae, Pohnpei, Truk, and Yap. It lies east of the Philippines in the Caroline Islands, extending from Kosrae (lat. 5°19'N. and long. 163°00'E.) north and west to Pohnpei (lat. 6°54'N. and long. 158°14'E.), Truk (lat. 7°45'N. and long. 151°42'E.) and Yap (lat. 9°33'N. and 138°09'E.) (*fig. 1*). An inventory in 1983 of timber resources was restricted to the high islands of Pohnpei and Kosrae; the four Truk islands of Dublon, Fefan, Moen, and Eten; and the four high islands of Yap—Yap, Maap, Rumung, and Gagil-Tamil.

Information on timber volume and forest land area was developed by combining data from vegetation type maps with observation and measurements collected on a grid of field plots. The vegetation type maps were the product of earlier studies (Falanruw and others 1987a, 1987b; MacLean and others 1986; Whitesell and others 1986). Field data were collected by the Forest Service's Pacific Northwest and Pacific Southwest Forest and Range Experiment Stations, the Hawaii Division of Forestry and Wildlife, the Peace Corps, and the States of Kosrae, Pohnpei, Truk, and Yap.

This bulletin reports areas of forest land, by forest type and land class, and timber volumes, by tree component and forest type, for the four States of Kosrae, Pohnpei, Truk, and Yap, Federated States of Micronesia.

## INVENTORY PROCEDURES

The inventory was designed to determine the area of land suitable for the production of industrial wood (i.e., timberland) and estimate the volume of timber present. The field inventory was limited to forest land believed to be potentially capable of growing timber. Lands mapped as nonforest, secondary vegetation, or agroforest were not sampled. The sample was further restricted by excluding lands mapped as atoll forest, dwarf forest, or size class "0" (incapable of growing stands of trees larger than 12.5 cm in d.b.h.) on the assumption that these lands were "other forest" not capable of growing 1.4 cubic meters per hectare (20 ft<sup>3</sup>/acre) per year of industrial wood. The location and area of the forest land types were available from type maps prepared for earlier studies (Falanruw and others 1987a, 1987b; MacLean and others 1986; Whitesell and others 1986).

The inventory design approximated stratified random sampling as described by Cochran (1963), but plots were selected on a square grid. Eight strata were identified, including four types—upland forest, mangrove, palm, and lowland swamp. Upland forest was further subdivided into five strata that differed in d.b.h. and density. The area of each stratum was measured from the type maps, thus providing a means of expanding plot data from the per hectare level to the stratum and State level. Square grids were laid out on the type maps of each State. Each grid intersection that fell in one of the eight

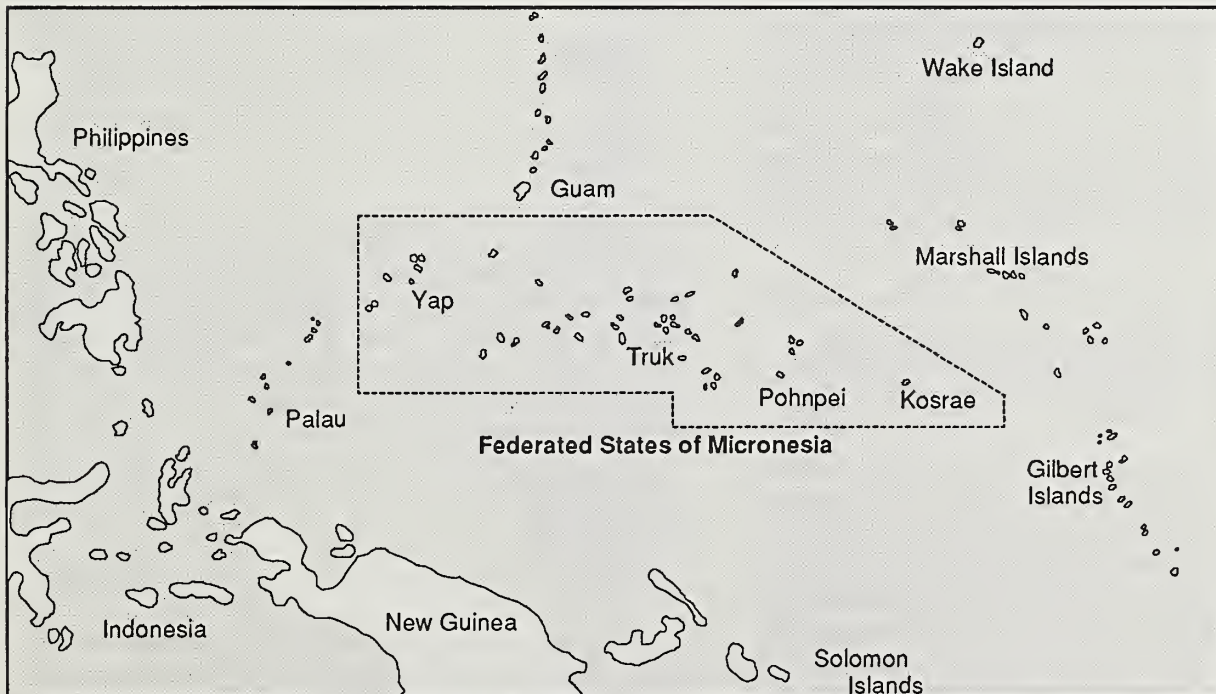


Figure 1—The Federated States of Micronesia are located in the Caroline Island group.



timberland strata was selected as a field plot: 36 plots on Pohnpei, 38 plots on Kosrae, 11 plots on Yap, and 5 plots on Truk. All selected grid points were pinpricked on aerial photos and located on the ground.

Ground examination revealed that some of the land typed as forest had since been converted to agroforest. Other grid points fell on slopes (generally in excess of 100 percent) believed to be too steep to permit growing of continuous crops of industrial wood. The remaining land was classed as timberland: 22 timberland plots on Pohnpei, 17 timberland plots on Kosrae, 2 plots on Truk and 11 plots on Yap. However, of the 11 plots on Yap, 5 fell in agricultural inclusions too small to delineate on the type map and 1 fell in a recent burn, leaving only 5 timbered plots.

Each timberland field plot was carefully located from the pinpricked location on the aerial photographs and permanently referenced for future remeasurement. At each location, a cluster of five sample points was established, with the points distributed over about 2.5 hectares (6 acres). At each point, all trees with d.b.h. between 12.5 and 90 centimeters (5 and 35 in) were tallied if they were "in" with a metric 7-factor (English 30.5-factor) prism sample (Grosenbaugh 1958). In addition, all trees that were larger than 90 centimeters (35 in) in d.b.h. and within 17 meters (55.8 ft) of plot center were tallied, as were trees less than 12.5 centimeters (5 in) in d.b.h. and within 2.36 m (7.7 ft) of plot center.

Species, d.b.h., and total height were recorded for each tree tallied. In addition, each tree was visually divided into logical segments and lengths and end diameters of these segments were measured or estimated. The segments were then classed as either sawlogs, poletimber, roughwood, upper stems, craftwood bolts, crotches, tips, or branches. Rotten segments were identified as cull and trees with less than 25 percent sound wood were identified as rotten culls. With these measurements, it was possible to calculate the sound cubic volume in each segment of each tally tree, thus enabling us to report tree volume by class of material.

Each sample point was marked and referenced, and each tally tree was tagged and numbered to facilitate relocation and remeasurement. Thus, when the plots are revisited, measurements of d.b.h. growth and tree mortality will be possible.

## RELIABILITY OF INVENTORY DATA

Forest area statistics based on the type maps are without sampling error, although unknown amounts of technique error may be present. But estimates of timberland area on Pohnpei and Kosrae were developed by multiplying the mapped inventory area by the proportion of field plots that proved to be timberland—not agroforest and not classed as too steep for management. Estimates of timberland area for strata where the estimated proportion of timberland was less than 1.0 but greater than 0 were subject to sampling error. If, however, all plots in a given stratum—e.g., mangrove—were timberland, the esti-

mated area for that stratum was without sampling error. Thus, the estimates of timberland area in upland, palm and swamp forest types on Pohnpei and the estimate of timberland area in upland type on Kosrae are all subject to sampling error, while the estimates of other timberland areas such as mangrove type are without sampling error, as are the estimates of timberland areas for the States of Yap and Truk. Since estimates of volume are derived from sample measurements, they are all subject to sampling error. The sample size in the State of Truk was inadequate for calculation of a confidence interval for volume. Confidence intervals for estimates of area and volume (68 percent probability level) on Pohnpei, Kosrae, and Yap follow:

| State and forest type | Timberland area<br><i>Hectares</i>              | Net volume<br><i>1,000 m<sup>3</sup></i>      |
|-----------------------|---|---|
| <b>Pohnpei</b>        |   |   |
| Upland                | 10,170 ± 1,960                                  | 2,007 ± 549                                   |
| Palm                  | 1,037 ± 424                                     | 248 ± 105                                     |
| Mangrove              | 5,290 ± 0                                       | 403 ± 190                                     |
| Swamp                 | 214 ± 214                                       | 30 ± 30                                       |
| All types             | 16,717 ± 2,017<br>(41,308 ± 4,984) <sup>1</sup> | 2,688 ± 591<br>(94,926 ± 20,871) <sup>2</sup> |
| <b>Kosrae</b>         |   |   |
| Upland                | 1,747 ± 486                                     | 163 ± 44                                      |
| Mangrove              | 1,562 ± 0                                       | 119 ± 17                                      |
| Swamp                 | 388 ± 0   | 56 ± 24                                       |
| All types             | 3,697 ± 486<br>(9,135 ± 1,201) <sup>1</sup>     | 338 ± 53<br>(11,936 ± 1,872) <sup>2</sup>     |
| <b>Yap</b>            |   |   |
| Upland                | 2,347 ± 0                                       | 45 ± 26                                       |
| Mangrove              | 1,145 ± 0                                       | 71 ± 43                                       |
| Swamp                 | 155 ± 0   | 0 ± 0   |
| All types             | 3,647 ± 0<br>(9,012 ± 0) <sup>1</sup>           | 116 ± 50<br>(4,096 ± 1,766) <sup>2</sup>      |

<sup>1</sup>Acres.

<sup>2</sup>1,000 ft<sup>3</sup>.

Confidence intervals are quantitative expressions of the reliability of the timberland area and volume statistics. The above tabulation, for example, indicates a two-in-three chance that there are between 14,700 and 18,700 hectares (36,000 and 46,000 acres) of timberland on the island of Pohnpei, and between 2.097 million and 3.279 million cubic meters (74 million and 115 million ft<sup>3</sup>) of timber volume.

## RESULTS

• This forest inventory covered 60,625 hectares (149,804 acres), of which 24,326 hectares (60,110 acres) were in timberland (*table 1*).<sup>1</sup>

<sup>1</sup>Tree names are listed in *Appendix A*. All tables are in *Appendix B*.



• The upland forest type occupied most of the forest land—12,548 hectares (31,006 acres) in Pohnpei (*table 2*); 5,077 hectares (12,545 acres) in Kosrae (*table 3*); and 2,556 hectares (6,316 acres) in Yap (*table 4*): On Truk the mangrove forest type occupied all of the forest land—306 hectares (756 acres) (*table 5*).

• The volume of standing timber in 1,000 cubic meters (million ft<sup>3</sup>), by State was: Pohnpei—2,688 (94.9); Kosrae—338 (11.9); Truk—5 (0.2); and Yap—116 (4.1) (*table 6*).

• About two-thirds of the timber volume was in sawtimber and one-third in poletimber (*tables 7-9*).

• The species accounting for the most timber volume, by State, were: *Clinostigma ponapensis* and *Campnosperma brevipetiolata* in Pohnpei (*table 10*); *Horsfieldia nunu* in Kosrae (*table 11*); and *Sonneratia alba* in Yap (*table 12*).

• The volume of tree fern (*Cyathea* spp. Sm. [*Cyatheaceae*]) on Pohnpei, Kosrae, and Yap totaled 312,000 cubic meters (11 million ft<sup>3</sup>) (*table 13*).

## APPENDIX A—TREE NAMES AND FAMILIES<sup>1</sup>

### Scientific name

### Family

*Adenanthra pavonina* L.  
*Barringtonia racemosa* (L.) Spreng.  
*Bruguiera gymnorhiza* (L.) Lam.  
*Calophyllum inophyllum* L.  
*Campnosperma brevipetiolata* Volk.  
*Cananga odorata* (Lam.) Hook. f. & Thoms.  
*Cinnamomum carolinense* Koidz.  
*Clinostigma carolinensis* (Becc.) Moore & Fosb.  
*Clinostigma ponapensis* (Becc.) Moore & Fosb.  
*Discocalyx ponapensis* Mez  
*Elaeocarpus carolinensis* Koidz.  
*Elaeocarpus kusanoi* Kaneh.  
*Eugenia stelechantha* (Diels) Kaneh.  
*Garcinia ponapensis* Laut.  
*Glochidion* spp. Forst.  
*Hibiscus tiliaceus* L.  
*Horsfieldia nunu* Kaneh.  
*Intsia bijuga* (Colebr.) O. Ktze.  
*Mangifera indica* L.  
*Manilkara hoshinoi* (Kaneh.) P. v. Roy  
*Metroxylon amicarum* (Wendl.) Becc.  
*Myristica insularis* Kaneh.  
*Neubergia celebica* (Koord.) Leenhouts.  
*Palaquium karrak* Kaneh.  
*Parinari laurina* Gray  
*Pongamia pinnata* (L.) Merr.  
*Rhizophora apiculata* Bl.  
*Rhizophora mucronata* Lam.  
*Sonneratia alba* J.E. Smith  
*Terminalia carolinensis* Kaneh.  
*Terminalia catappa* L.  
*Xylocarpus granatum* Koen.

Mimosaceae  
 Lecythidaceae  
 Rhizophoraceae  
 Guttiferae  
 Anacardiaceae  
 Annonaceae  
 Lauraceae  
 Palmae  
 Palmae  
 Myrsinaceae  
 Tiliaceae  
 Tiliaceae  
 Myrtaceae  
 Guttiferae  
 Euphorbiaceae  
 Malvaceae  
 Myristicaceae  
 Leguminosae  
 Anacardiaceae  
 Sapotaceae  
 Palmae  
 Myristicaceae  
 Loganiaceae  
 Sapotaceae  
 Rosaceae  
 Fabaceae  
 Rhizophoraceae  
 Rhizophoraceae  
 Sonneratiaceae  
 Combretaceae  
 Combretaceae  
 Meliaceae

## APPENDIX B—TABLES

Table 1—Area, by land class and State, Federated States of Micronesia, 1983

| Land class           | Area by State           |        |                   |       |                  |
|----------------------|-------------------------|--------|-------------------|-------|------------------|
|                      | Pohnpei                 | Kosrae | Truk <sup>1</sup> | Yap   | Total            |
|                      | <i>Hectares (acres)</i> |        |                   |       |                  |
| Forest land:         |                         |        |                   |       |                  |
| Timberland           | 16,717                  | 3,697  | 265               | 3,647 | 24,326 (60,110)  |
| Other forest:        |                         |        |                   |       |                  |
| Steep <sup>2</sup>   | 2,713                   | 3,330  | —                 | —     | 6,043 (14,932)   |
| Scrub <sup>3</sup>   | 253                     | 69     | 44                | 235   | 601 (1,485)      |
| Total                | 19,683                  | 7,096  | 309               | 3,882 | 30,970 (76,527)  |
| Secondary vegetation | 1,843                   | 1,213  | 252               | 553   | 3,861 (9,540)    |
| Agroforest           | 11,865                  | 2,614  | 3,055             | 2,538 | 20,072 (49,598)  |
| Nonforest            | 2,098                   | 264    | 554               | 2,806 | 5,722 (14,139)   |
| All lands            | 35,489                  | 11,187 | 4,170             | 9,779 | 60,625 (149,804) |

<sup>1</sup>Islands of Moen, Dublon, Fefan, and Eten.

<sup>2</sup>Land supporting stands of timber species but considered unsuitable for timber growing because of slopes in excess of 100 percent.

<sup>3</sup>Incapable of growing trees of size and form suitable for commercial use.

Table 2—Area of forest land, by forest type and land class, Pohnpei, 1983

| Forest type | Land class              |                                   |                                   |                 |
|-------------|-------------------------|-----------------------------------|-----------------------------------|-----------------|
|             | Timberland              | Other forest (steep) <sup>1</sup> | Other forest (scrub) <sup>2</sup> | Total forest    |
|             | <i>Hectares (acres)</i> |                                   |                                   |                 |
| Upland      | 10,170                  | 2,367                             | 11                                | 12,548 (31,006) |
| Mangroves   | 5,290                   | —                                 | 235                               | 5,525 (13,652)  |
| Palm        | 1,037                   | 346                               | —                                 | 1,383 (3,417)   |
| Swamp       | 214                     | —                                 | —                                 | 214 (529)       |
| Plantation  | 6                       | —                                 | —                                 | 6 (15)          |
| Dwarf       | —                       | —                                 | 1                                 | 1 (2)           |
| Atoll       | —                       | —                                 | 6                                 | 6 (15)          |
| All types   | 16,717                  | 2,713                             | 253                               | 19,683 (48,636) |

<sup>1</sup>Land supporting stands of timber species but considered unsuitable for timber growing because of slopes in excess of 100 percent.

<sup>2</sup>Incapable of growing trees of size and form suitable for commercial use.

<sup>1</sup>Sources: Fosberg and others (1979) and Fosberg and others (1980) for names of Dicotyledonae; Moore and Fosberg (1956) for names of palms.

Table 3—Area of forest land, by forest type and land class, Kosrae, 1983

| Forest type | Land class              |                                   |                                   | Total forest   |
|-------------|-------------------------|-----------------------------------|-----------------------------------|----------------|
|             | Timberland              | Other forest (steep) <sup>1</sup> | Other forest (scrub) <sup>2</sup> |                |
|             | <i>Hectares (acres)</i> |                                   |                                   |                |
| Upland      | 1,747                   | 3,330                             | —                                 | 5,077 (12,545) |
| Mangroves   | 1,562                   | —                                 | —                                 | 1,562 (3,860)  |
| Swamp       | 388                     | —                                 | —                                 | 388 (959)      |
| Dwarf       | —                       | —                                 | 69                                | 69 (170)       |
| All types   | 3,697                   | 3,330                             | 69                                | 7,096 (17,534) |

<sup>1</sup>Land supporting stands of timber species but considered unsuitable for timber growing because of slopes in excess of 100 percent.

<sup>2</sup>Incapable of growing trees of size and form suitable for commercial use.

Table 4—Area of forest land, by forest type and land class, Yap, 1983

| Forest type | Land class              |                                   | Total forest  |
|-------------|-------------------------|-----------------------------------|---------------|
|             | Timberland              | Other forest (scrub) <sup>1</sup> |               |
|             | <i>Hectares (acres)</i> |                                   |               |
| Upland      | 2,347                   | 209                               | 2,556 (6,316) |
| Mangroves   | 1,145                   | 26                                | 1,171 (2,894) |
| Swamp       | 155                     | —                                 | 155 (383)     |
| All types   | 3,647                   | 235                               | 3,882 (9,593) |

<sup>1</sup>Incapable of growing trees of size and form suitable for commercial use.

Table 5—Area of forest land, by forest type and land class, Truk, 1983

| Forest type         | Land class              |                                   | Total forest |
|---------------------|-------------------------|-----------------------------------|--------------|
|                     | Timberland              | Other forest (scrub) <sup>1</sup> |              |
|                     | <i>Hectares (acres)</i> |                                   |              |
| Upland <sup>2</sup> | —                       | —                                 | —            |
| Mangroves           | 262                     | 44                                | 306 (756)    |
| Palm                | 2                       | —                                 | 2 (5)        |
| Plantation          | 1                       | —                                 | 1 (2)        |
| All types           | 265                     | 44                                | 309 (765)    |

<sup>1</sup>Incapable of growing trees of size and form suitable for commercial use.

<sup>2</sup>Three field plots fell on land mapped as upland forest but all three have been converted to agroforest. Thus, all land mapped as upland forest is assumed to be now agroforest.

Table 6—Volume of timber on timberland, by forest type and State, Federated States of Micronesia, 1983

| Forest type | State   |        |                   |     | All States      |
|-------------|---|--------|-------------------|-----|-----------------|
|             | Pohnpei                                       | Kosrae | Truk <sup>1</sup> | Yap |                 |
|             | 1,000 m <sup>3</sup> (1,000 ft <sup>3</sup> ) |        |                   |     |                 |
| Upland      | 2,007   | 163    | —                 | 45  | 2,215 (78,222)  |
| Palm        | 248   | —      | —                 | —   | 248 (8,758)     |
| Mangrove    | 403   | 119    | 5                 | 71  | 598 (21,118)    |
| Swamp       | 30  | 56     | —                 | —   | 86 (3,037)      |
| All types   | 2,688   | 338    | 5                 | 116 | 3,147 (111,135) |

<sup>1</sup>Only two field plots fell on timberland—both mangrove. Average volume on two plots, 19.5 cubic meters per hectare; therefore, no estimate made of volume, by species, or by class of material.

Table 7—Volume of timber on timberland, by tree component and forest type, Pohnpei, 1983

| Tree component    | Forest type          |             |                 |              | All types      |
|-------------------|----------------------|-------------|-----------------|--------------|----------------|
|                   | Upland forest        | Palm forest | Mangrove forest | Swamp forest |                |
|                   | 1,000 m³ (1,000 ft³) |             |                 |              |                |
| Sawtimber:        |                      |             |                 |              |                |
| Sawlog            | 681                  | 79          | 65              | 21           | 846 (29,876)   |
| Upper stem        | 83                   | 23          | 22              | 3            | 131 (4,626)    |
| Craftwood bolts   | 71                   | 4           | 38              | 1            | 114 (4,026)    |
| Branch and crotch | 68                   | 6           | 20              | 1            | 95 (3,355)     |
| Tip               | 2                    | 1           | 2               | —            | 5 (177)        |
| Roughwood         | 418                  | 46          | 36              | —            | 500 (17,657)   |
| Total             | 1,323                | 159         | 183             | 26           | 1,691 (59,717) |
| Poletimber:       |                      |             |                 |              |                |
| Poletimber        | 671                  | 86          | 197             | 4            | 958 (33,831)   |
| Tip               | 8                    | 3           | 13              | —            | 24 (848)       |
| Branch            | 6                    | 1           | 9               | —            | 15 (530)       |
| Total             | 684                  | 89          | 219             | 4            | 997 (35,209)   |
| Total volume      | 2,007                | 248         | 403             | 30           | 2,688 (94,926) |

Table 8—Volume of timber on timberland, by tree component and forest type, Kosrae, 1983

| Tree component    | Forest type                                   |                 |              | All types    |
|-------------------|---|-----------------|--------------|--------------|
|                   | Upland forest                                 | Mangrove forest | Swamp forest |              |
|                   | 1,000 m <sup>3</sup> (1,000 ft <sup>3</sup> ) |                 |              |              |
| Sawtimber:        |   |                 |              |              |
| Sawlog            | 88  | 40              | 40           | 168 (5,933)  |
| Upper stem        | 5   | 7               | 2            | 14 (494)     |
| Craftwood bolts   | 3   | 7               | 2            | 12 (424)     |
| Branch and crotch | 10  | 6               | 2            | 18 (636)     |
| Tip               | —   | 1               | —            | 1 (35)       |
| Roughwood         | 34  | 18              | 5            | 57 (2,013)   |
| Total             | 140   | 79              | 51           | 270 (9,535)  |
| Poletimber:       |   |                 |              |              |
| Poletimber        | 19  | 36              | 5            | 60 (2,119)   |
| Tip               | 1   | 3               | —            | 4 (141)      |
| Branch            | 3   | 1               | —            | 4 (141)      |
| Total             | 23  | 40              | 5            | 68 (2,401)   |
| Total volume      | 163   | 119             | 56           | 338 (11,936) |

Table 9—Volume of timber on timberland, by tree component and forest type, Yap, 1983

| Tree component    | Forest type                                   |                 | All types   |
|-------------------|---|-----------------|-------------|
|                   | Upland forest                                 | Mangrove forest |             |
|                   | 1,000 m <sup>3</sup> (1,000 ft <sup>3</sup> ) |                 |             |
| Sawtimber:        |   |                 |             |
| Sawlog            | 12  | —               | 12 (424)    |
| Upper stem        | 2   | 6               | 8 (282)     |
| Craftwood bolts   | 7   | 5               | 12 (424)    |
| Branch and crotch | 1   | 2               | 3 (106)     |
| Tip               | —   | —               | —           |
| Roughwood         | 2   | 33              | 35 (1,236)  |
| Total             | 23  | 47              | 70 (2,472)  |
| Poletimber:       |   |                 |             |
| Poletimber        | 19  | 22              | 41 (1,448)  |
| Tip               | —   | —               | —           |
| Branch            | 3   | 2               | 5 (177)     |
| Total             | 22  | 24              | 46 (1,624)  |
| Total volume      | 45  | 71              | 116 (4,096) |



Table 10—Total volume on timberland, by species and forest type, Pohnpei, 1983

| Species                           | Forest type                                   |             |                 |              | All types |          |
|-----------------------------------|---|-------------|-----------------|--------------|-----------|----------|
|                                   | Upland forest                                 | Palm forest | Mangrove forest | Swamp forest |           |          |
|                                   | 1,000 m <sup>3</sup> (1,000 ft <sup>3</sup> ) |             |                 |              |           |          |
| <i>Adenanthera pavonina</i>       | —   | —           | —               | 2            | 2         | (71)     |
| <i>Bruguiera gymnorhiza</i>       | —   | —           | 127             | —            | 127       | (4,485)  |
| <i>Camposperma brevipetiolata</i> | 602   | 73          | —               | 6            | 681       | (24,049) |
| <i>Cananga odorata</i>            | —   | 2           | —               | —            | 2         | (71)     |
| <i>Cinnamomum carolinense</i>     | 3   | —           | —               | —            | 3         | (106)    |
| <i>Clinostigma carolinensis</i>   | 15  | —           | —               | —            | 15        | (530)    |
| <i>Clinostigma ponapensis</i>     | 826   | 128         | —               | —            | 955       | (33,726) |
| <i>Discocalyx ponapensis</i>      | 9   | —           | —               | —            | 9         | (318)    |
| <i>Elaeocarpus carolinensis</i>   | 154   | 4           | —               | 8            | 166       | (5,862)  |
| <i>Elaeocarpus kusanoi</i>        | —   | 2           | —               | —            | 2         | (71)     |
| <i>Eugenia stelechantha</i>       | 15  | —           | —               | —            | 15        | (520)    |
| <i>Garcinia ponapensis</i>        | —   | 1           | —               | —            | 1         | (35)     |
| <i>Hibiscus tiliaceus</i>         | 6   | —           | —               | —            | 6         | (212)    |
| <i>Intsia bijuga</i>              | —   | —           | —               | 2            | 2         | (71)     |
| <i>Mangifera indica</i>           | 50  | —           | —               | —            | 50        | (1,766)  |
| <i>Manilkara hoshinoi</i>         | —   | 2           | —               | —            | 2         | (71)     |
| <i>Metroxylon amicarum</i>        | 13  | —           | —               | —            | 13        | (459)    |
| <i>Myristica insularis</i>        | 170   | 13          | —               | 13           | 196       | (6,922)  |
| <i>Palaquium karrak</i>           | 7   | —           | —               | —            | 7         | (147)    |
| <i>Parinari laurina</i>           | 136   | 22          | —               | —            | 158       | (5,580)  |
| <i>Rhizophora apiculata</i>       | —   | —           | 58              | —            | 58        | (2,048)  |
| <i>Rhizophora mucronata</i>       | —   | —           | 12              | —            | 12        | (424)    |
| <i>Sonneratia alba</i>            | —   | —           | 99              | —            | 99        | (3,496)  |
| <i>Xylocarpus granatum</i>        | —   | —           | 107             | —            | 107       | (3,779)  |
| All species                       | 2,006   | 249         | 403             | 30           | 2,688     | (94,926) |

Table 11—Total volume on timberland, by species and forest type, Kosrae, 1983

| Species                           | Forest type                                   |                 |              | All types |          |
|-----------------------------------|---|-----------------|--------------|-----------|----------|
|                                   | Upland forest                                 | Mangrove forest | Swamp forest |           |          |
|                                   | 1,000 m <sup>3</sup> (1,000 ft <sup>3</sup> ) |                 |              |           |          |
| <i>Adenanthera pavonina</i>       | 14  | —               | —            | 14        | (494)    |
| <i>Barringtonia racemosa</i>      | —   | —               | 1            | 1         | (35)     |
| <i>Bruguiera gymnorhiza</i>       | —   | 13              | —            | 13        | (459)    |
| <i>Camposperma brevipetiolata</i> | 10  | —               | —            | 10        | (353)    |
| <i>Elaeocarpus carolinensis</i>   | 5   | —               | —            | 5         | (177)    |
| <i>Hibiscus tiliaceus</i>         | 9   | —               | 3            | 12        | (424)    |
| <i>Horsfieldia nunu</i>           | 114   | —               | 26           | 140       | (4,944)  |
| <i>Neubergia celebica</i>         | 6   | —               | 1            | 7         | (247)    |
| <i>Rhizophora apiculata</i>       | —   | 15              | —            | 15        | (530)    |
| <i>Rhizophora mucronata</i>       | —   | 35              | —            | 35        | (1,236)  |
| <i>Sonneratia alba</i>            | —   | 56              | —            | 56        | (1,978)  |
| <i>Terminalia carolinensis</i>    | 2   | —               | 17           | 19        | (671)    |
| <i>Terminalia catappa</i>         | 3   | —               | 8            | 11        | (388)    |
| All species                       | 163   | 119             | 56           | 338       | (11,936) |

Table 12—Total volume on timberland, by species and forest type, Yap, 1983

| Species                            | Forest type                                   |                 | All types   |
|------------------------------------|---|-----------------|-------------|
|                                    | Upland forest                                 | Mangrove forest |             |
|                                    | 1,000 m <sup>2</sup> (1,000 ft <sup>2</sup> ) |                 |             |
| <i>Bruguiera gymnorhiza</i>        | —   | 22              | 22 (777)    |
| <i>Calophyllum inophyllum</i>      | 15  | —               | 15 (530)    |
| <i>Campnosperma brevipetiolata</i> | 12  | —               | 12 (424)    |
| <i>Glochidion</i> spp.             | 4   | —               | 4 (141)     |
| <i>Hibiscus tiliaceus</i>          | 12  | —               | 12 (424)    |
| <i>Pongamia pinnata</i>            | 2   | —               | 2 (71)      |
| <i>Rhizophora apiculata</i>        | —   | 15              | 15 (530)    |
| <i>Sonneratia alba</i>             | —   | 34              | 34 (1,201)  |
| All species                        | 45  | 71              | 116 (4,096) |

Table 13—Volume of tree fern on timberland by State and forest type, Federated States of Micronesia, 1983<sup>1</sup>

| State       | Forest type                                   |             |                 |              | All types    |
|-------------|---|-------------|-----------------|--------------|--------------|
|             | Upland forest                                 | Palm forest | Mangrove forest | Swamp forest |              |
|             | 1,000 m <sup>3</sup> (1,000 ft <sup>3</sup> ) |             |                 |              |              |
| Pohnpei     | 215   | 3           | —               | —            | 219 (7,734)  |
| Kosrae      | 47  | —           | —               | 46           | 93 (3,284)   |
| Yap         | —   | —           | —               | —            | —            |
| All islands | 262   | 3           | —               | 46           | 312 (11,018) |

<sup>1</sup>Totals may vary due to round-off.

## GLOSSARY

**Agroforest:** Land where planted fruit trees and other agricultural plants are cultured among forest trees.

**Branches:** Tree limbs not meeting sawlog or bolt specifications.

**Craftwood bolts:** Two-meter (6-ft) sections of trees that are at least 27.5 centimeters (11 in) in d.b.h. Must have mid-point diameters of at least 25 centimeters (10 in) and must not meet sawlog specifications. **Crotches:** The swollen portions of tree stems at forks.

**Cull:** A volume deduction for rotten wood.

**Cull trees, rotten:** Trees that are more than 75 percent defective because of rot.

**D.b.h. (diameter at breast height):** Diameter at a point 1.3 meters (4.26 ft) above the ground on the uphill side of normally formed trees or 0.5 m (1.6 ft) above the butt swell of abnormally formed trees.

**Forest land:** Land at least 10 percent stocked by live trees or land formerly having such tree cover and not currently developed for nonforest or agroforest use.

**Forest plantations:** Planted forests in which at least 10 percent of growing space is occupied by planted trees.

**Forest type:** A vegetation type where the predominant cover is trees. Forest types recognized in this report are:

**Atoll forests:** Associations of species generally occurring toward the interior of larger and wetter uninhabited atolls and on sandy or rocky coasts of low and high islands.

**Dwarf forests:** Forests of small, poorly formed trees growing on an exposed site, generally at a high elevation.

**Mangrove forests:** Forests where mangrove species predominate and tree roots are periodically inundated by sea water.

**Palm forests:** Forest associations where native palms predominate.

**Plantation forests:** Planted stands of exotic timber species.

**Swamp forests:** Forest associations found in low-lying fresh water areas inland of the mangroves, in river bottoms, and elsewhere where the water table is high.

**Upland forests:** Forests where palms do not predominate and where the water table is too low to support mangrove or swamp forest species.

**Grassland:** Nonforest land with 10 percent or more herbaceous cover and not cultivated or developed for urban use.

**Industrial wood:** All commercial roundwood except fuelwood.

**Land class:** A classification of land by major use. The minimum size for area classification is 1 hectare (2.5 acres).

**Net volume:** Cubic volume, exclusive of rotten wood.

**Nonforest land:** Land that has never supported forests or land that formerly supported forests but is developed for nonforest use.

**Other forest land:** Forest land incapable of producing trees of merchantable size ( $\geq 12.5$  cm in d.b.h.) because of adverse site conditions or land that is physically unsuited for the production of continuous crops of industrial wood because of rocky or steep terrain.

**Poletimber trees:** Live trees that are between 12.5 centimeters (5 in) and 27.5 centimeters (11 in) in d.b.h.

**Poletimber volume:** The net cubic volume in poletimber trees.

**Roughwood:** Logs of sawtimber size that fail to meet sawlog specifications because of poor form or excessive limbs.

**Sawlogs:** Straight segments of sawtimber trees that are at least 2.5 meters (8.2 ft) long and no less than 22.5 centimeters (9 in) in diameter outside the bark at the small end.

**Sawtimber trees:** Live trees that are at least 27.5 centimeters (11 in) in d.b.h.

**Sawtimber volume:** The net cubic volume in sawtimber trees.

**Secondary vegetation:** A vegetation type characterized by small, fast-growing trees and vines, usually weedy invaders.

**Stump:** The portion of a tree that lies below a point 0.3 meters (1 ft) above the ground or, for a tree with a swollen or fluted butt, the portion that lies below the top of the swelling.

**Timberland:** Forest land capable of producing at least 1.4 cubic meters per hectare (20 ft<sup>3</sup>/acre) per year of industrial wood and not withdrawn from timber utilization.

**Timber volume:** The net cubic volume of all poletimber and sawtimber trees, including tip and branches but excluding stump.

**Tip:** The portion of the main stem of a sawtimber or poletimber tree that is less than 10 centimeters (4 in) in diameter outside the bark.

**Tree component:** A segment of a tree with specific utilization characteristics (bolt, branch, crotch, roughwood, sawlog, tip, upper stem).

**Upper stem:** The bole of a sawtimber tree above the sawlog top—22.5 centimeters (9 in) outside the bark—to a minimum top diameter of 10 centimeters (4 in) outside the bark or to the point where the central stem breaks into limbs.

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The Forest Service, U.S. Department of Agriculture, is responsible for Federal leadership in forestry. It carries out this role through four main activities:

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- Cooperation with State and local governments, forest industries, and private landowners to help protect and manage non-Federal forest and associated range and watershed lands.
- Participation with other agencies in human resource and community assistance programs to improve living conditions in rural areas.
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**The Pacific Southwest Forest and Range Experiment Station**

- Represents the research branch of the Forest Service in California, Hawaii, and the western Pacific.
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MacLean, Colin D.; Whitesell, Craig D.; Cole, Thomas G.; McDuffie, Katharine E.  
1988. **Timber resources of Kosrae, Pohnpei, Truk, and Yap, Federated States of Micronesia.** Resour. Bull. PSW-24. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 8 p.

In a forest inventory of the four states of the Federated States of Micronesia, 60,625 hectares (149,804 acres) were surveyed, of which 24,326 hectares (60,110 acres) were timberland. This timberland has an estimated 3.1 million cubic meters (111.1 million ft<sup>3</sup>) of standing timber. An estimated 2.7 million cubic meters (95.3 million ft<sup>3</sup>) of the timber volumes were in the State of Pohnpei; 338,000 cubic meters (11.9 million ft<sup>3</sup>) in the State of Kosrae; 5,000 cubic meters (176,600 ft<sup>3</sup>) in Truk; and 16,000 cubic meters (565,000 ft<sup>3</sup>) in Yap.

*Retrieval Terms:* forest surveys, forest inventory, timber, Kosrae, Pohnpei, Truk, Yap, Federated States of Micronesia, Caroline Islands, Micronesia